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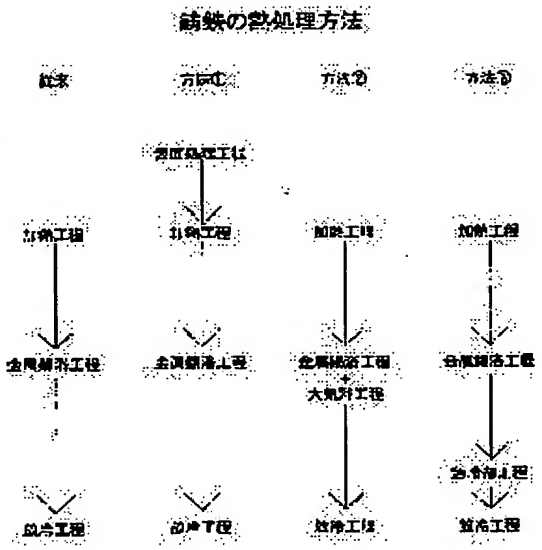
(54) HEAT TREATMENT METHOD FOR CAST IRON

(57)Abstract:
PROBLEM TO BE SOLVED: To produce a cast iron product to which tin used in a metal bath is not stuck.
SOLUTION: Before austenizing the cast iron, the cast iron is coated with a surface treating material which is not reacted with molten tin (surface treating process) so that the cast iron is not brought into direct contact with the molten tin. Besides, in an austemper treatment, after dipping the cast iron into the molten tin, the cast iron is exposed to the atmosphere having the same temperature as the temperature of the metal bath (atmospheric bath process) to remove the molten tin under sticking process. Further, after the austemper treatment of the cast iron, the cast iron dipped into the molten tin, is taken out and the cast iron is dipped into cooling liquid for a prescribed time (rapid cooling process) to remove the stuck molten tin.



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CLAIMS

[Claim(s)]
[Claim 1] The heat treatment approach of the cast iron which heats and austenitizes cast iron at 800 degrees C - 1000 degrees C, is made to immerse and carry out isothermal transformation to 250 degrees C - 450 degrees C melting tin bath after that, carries out cooling maintenance, and is characterized by to cover the above-mentioned melting tin and the surface treatment material which does not react to the above-mentioned cast iron in the heat treatment approach of cast iron of performing austempering processing before austenitizing.
[Claim 2] The heat treatment approach of the cast iron according to claim 1 characterized by making into 20 minutes - 300 minutes time amount immersed in the above-mentioned melting tin.
[Claim 3] The heat treatment approach of the cast iron according to claim 1 characterized by making into 20 minutes - 100 minutes time amount immersed in the above-mentioned melting tin.
[Claim 4] The heat treatment approach of the cast iron according to claim 1, 2, or 3 characterized by using kaolin powder for the above-mentioned surface treatment material.
[Claim 5] the above-mentioned surface treatment material -- the heat treatment approach of the cast iron according to claim 4 characterized by using kaolin powder 1 % of the weight to 100% of the weight to 100 % of the weight.
[Claim 6] The heat treatment approach of the cast iron according to claim 4 or 5 characterized by adding alumina powder to the above-mentioned surface treatment material.
[Claim 7] the above-mentioned surface treatment material -- the heat treatment approach of the cast iron according to claim 6 characterized by using alumina powder for kaolin powder 1 % of the weight to 50% of the weight 1 % of the weight to 100% of the weight to 100 % of the weight.

[Claim 8] The heat treatment approach of the cast iron which heats and austenitizes cast iron at 800 degrees C - 1000 degrees C, and make immerse for which and carry out isothermal transformation to 250 degrees C - 450 degrees C melting tin bath after that, and carries out cooling maintenance and which carries out [having exposed the above-mentioned cast iron to the atmospheric-air ambient atmosphere of the same temperature as the above-mentioned metal bath after being immersed in the above-mentioned melting tin by the above-mentioned austempering processing, and] as the description in the heat treatment approach of cast iron of performing austempering processing.
[Claim 9] The heat treatment approach of the cast iron according to claim 8 characterized by making into 10 minutes - 100 minutes time amount immersed in the above-mentioned melting tin.
[Claim 10] The heat treatment approach of the cast iron according to claim 8 characterized by making into 20 minutes - 60 minutes time amount immersed in the above-mentioned melting tin.
[Claim 11] The heat treatment approach of the cast iron according to claim 8, 9, or 10 characterized by making into 5 minutes - 20 minutes time amount exposed to the above-mentioned atmospheric-air ambient atmosphere.
[Claim 12] The heat treatment approach of the cast iron carried out [having heated and

austenitized cast iron at 800 degrees C - 1000 degrees C, having immersed and carried out isothermal transformation to 250 degrees C - 450 degrees C melting tin bath, having carried out cooling maintenance, having carried out the cast iron immersed in the above-mentioned melting tin after austempering processing of the above-mentioned cast iron in the heat treatment approach of cast iron of performing austempering processing at ejection, and having carried out predetermined-time immersion of this cast iron after that, at the coolant, and] as the description.

[Claim 13] The heat treatment approach of the cast iron according to claim 12 characterized by making into 20 minutes - 100 minutes time amount immersed in the above-mentioned melting tin.

[Claim 14] The heat treatment approach of the cast iron according to claim 12 characterized by making into 20 minutes - 60 minutes time amount immersed in the above-mentioned melting tin.

[Claim 15] The heat treatment approach of the cast iron according to claim 12, 13, or 14 characterized by using water for the above-mentioned coolant.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the heat treatment approach of cast iron, and relates to the heat treatment approach of cast iron that the metal tin of a metal bath does not adhere to a cast iron product.
[0002]
[Description of the Prior Art] after heating a cast iron product to austenitizing temperature in order to raise the mechanical property of a spheroidal-graphite-cast-iron product in recent years -- constant temperature -- research on the heat treatment approach of cast iron of manufacturing the so-called ADI (Austempered Ductile Cast Iron) product made into the structure of the base organization which consists of bainite and little retained austenite by austempering processing to hold is done. As the example, the thing using the equipment of a publication is in JP,7-136513,A. the heating process at which the heat treatment approach of the cast iron by this equipment austenitizes cast iron as shown in drawing 1 , and metal tin bath -- cast iron -- constant temperature -- it has the metal tin bath process which carries out maintenance processing, and the radiationnal-cooling process left in ordinary temperature in order to maintain the physical properties acquired by austempering processing. According to this approach, the structure of cast iron is heated and austenitized with a heating furnace in a heating process, subsequently, it is carried out on metal tin bath, and sudden cooling is carried out in a cooling process, and it carries out a bainite condition HE transformation from an austenite condition. The transformation condition of cast iron can be changed into the condition of having a desired mechanical property according to immersion time amount and retention temperature.
[0003]
[Problem(s) to be Solved by the Invention] By the way, by the heat treatment approach of conventional cast iron, in the case of the so-called cast iron product of **** like the cutter of a farming pawl or a casting, there is almost no adhesion of metal tin which causes trouble to an activity, but when it is a cast iron product with a complicated configuration, adhesion of metal tin which causes trouble to an activity may arise. For example, with the cast iron product which has irregularity inside with the cast iron product formed in the shape of a pipe, metal tin carries out coagulation adhesion physically in a crevice. In the case of the cast iron product formed in the shape of a pipe, the iron-oxide coat which is effective in preventing adhesion of metal tin is formed in a cast iron front face in detail at the time of austenitizing, but in the pipe-like inside, it will adhere so that metal tin may get twisted around an iron-oxide coat by solidification shrinkage. For this reason, if it remained as it is, metal tin adhered to the cast iron product, and the heat treatment approach of conventional cast iron had the problem of causing trouble to an activity.
[0004] This invention was made in view of such a trouble, and aims at offering the heat treatment approach of the cast iron which generates the cast iron product to which the tin used with the metal bath does not adhere.
[0005]

[Means for Solving the Problem] The technical means of this invention for solving such a technical problem heated and austenitized cast iron at 800 degrees C - 1000 degrees C, isothermal transformation of them was immersed and carried out to 250 degrees C - 450 degrees C melting tin bath after that, and they carried out cooling maintenance, and in the heat treatment approach of cast iron of performing austempering processing, before austenitizing, they were considered as the above-mentioned melting tin and the configuration which covered the surface-treatment material which does not react at the above-mentioned cast iron. Melting tin and the surface treatment material which does not react contact cast iron and directly into melting tin bath, and since melting tin and cast iron do not contact, they can prevent adhesion of metal tin. Moreover, time amount immersed in the above-mentioned melting tin was made into 20 - 300 minutes if needed. Since the immersed time amount brought about the change of state of the cast iron obtained and influenced the mechanical strength, it was made into required sufficient immersion time amount from which a desired mechanical strength is obtained. Furthermore, time amount immersed in the above-mentioned melting tin was made into 20 minutes - 100 minutes if needed. By shortening immersion time amount, time amount required for the heat treatment approach is shortened. Furthermore, kaolin powder was used for the above-mentioned surface treatment material again if needed. Kaolin powder can cover a cast iron front face in the thickness of homogeneity, and it also prevents the fixing coagulation to the coat body surface of metal tin while it prevents metal tin contacting direct cast iron. moreover, the need -- responding -- the above-mentioned surface treatment material -- kaolin powder was used to 100 % of the weight 1 % of the weight to 100% of the weight. If the content of the kaolin powder in surface treatment material is made into the request range, the coat nature on the front face of cast iron and the prevention effect of the fixing coagulation to a coat body surface will turn into validity more. Furthermore, alumina powder was added to the above-mentioned surface treatment material if needed. Into kaolin powder, even if it carries out the amount addition of requests of the alumina powder, a cast iron front face can be covered in the thickness of homogeneity, and while preventing metal tin contacting direct cast iron, the fixing coagulation to the coat body surface of metal tin is also prevented. furthermore -- again -- the need -- responding -- the above-mentioned surface treatment material -- alumina powder was used for kaolin powder to 100 % of the weight 1 % of the weight to 50% of the weight 1 % of the weight to 100% of the weight. If the addition ratio of the alumina powder to kaolin powder is made into request within the limits when alumina powder is added into kaolin powder, a cast iron front face can be covered in the thickness of homogeneity, and while preventing metal tin contacting direct cast iron, the fixing coagulation to the coat body surface of metal tin will also fully be prevented.

[0006] It carried out as the configuration exposed to the atmospheric-air ambient atmosphere of the temperature same at the above-mentioned austempering processing as the above-mentioned metal bath after being immersed [cast iron / above-mentioned] in the above-mentioned melting tin in the heat treatment approach of the cast iron which heats cast iron at 800 degrees C - 1000 degrees C, austenitizes, is immersed in melting (after that and 250 degrees C - 450 degrees C) tin bath, is made to carry out isothermal transformation, carries out cooling maintenance, and performs austempering processing. Although an oxide skin is formed in a cast iron front face of austenitizing and adhesion on the cast iron front face of metal tin is prevented, metal tin carries out solidification shrinkage to the oxide skin which irregularity produced in the metal bath, and adheres to it. It is made to secede from the metal tin in an adhesion process according to a gravity operation etc. by exposing to the atmospheric-air ambient atmosphere of the temperature same after a metal bath as a metal bath. Moreover, time amount immersed in the above-mentioned melting tin was made into 10 minutes - 100 minutes if needed. The cast iron obtained can be made to produce the change of state which brings about a desired mechanical strength by making into the time amount range of desired time amount immersed in melting tin. Furthermore, time amount immersed in the above-mentioned melting tin was made into 20 minutes - 60 minutes if needed. By shortening immersion time amount, time amount required for the heat treatment approach is shortened. Furthermore, time amount exposed to the above-mentioned atmospheric-air ambient atmosphere was made into 5 minutes

- 20 minutes again if needed. If the cast iron which gave the metal bath is exposed to an atmospheric-air ambient atmosphere desired time, cast iron can be made to secede from the melting tin in an adhesion process.

[0007] It carried out as the configuration which heated and austenitized cast iron at 800 degrees C - 1000 degrees C, was made to immerse and carry out isothermal transformation to 250 degrees C - 450 degrees C melting tin bath after that, carried out cooling maintenance, carried out the cast iron immersed in the above-mentioned melting tin after austempering processing of the above-mentioned cast iron in the heat treatment approach of cast iron of performing austempering processing at ejection, and carried out predetermined-time immersion of this cast iron at the coolant. Metal tin carries out solidification shrinkage to the oxide skin of the irregularity formed on the surface of cast iron after austempering processing, and adheres to it. By cooling a cast iron front face temporarily by the coolant after austempering processing, a surface of metal contracts, physical gap arises in the cast iron with which contraction differs, and the metal tin adhering to a cast iron front face, and metal tin secedes from a cast iron front face. Moreover, time amount immersed in the above-mentioned melting tin was made into 20 minutes - 100 minutes if needed. Since the immersed time amount brought about the change of state of the cast iron obtained and influenced the mechanical strength, it was made into required sufficient immersion time amount from which a desired mechanical strength is obtained. Furthermore, time amount immersed in the above-mentioned melting tin was made into 20 minutes - 60 minutes if needed. By shortening immersion time amount, time amount required for the heat treatment approach is shortened. Furthermore, water was used for the above-mentioned coolant again if needed. Since heat capacity is large, water is effective in cooling processing.

[0008]

[Embodiment of the Invention] Hereafter, the heat treatment approach of the cast iron applied to the gestalt of operation of this invention based on an accompanying drawing is explained. The heat treatment approach of cast iron is heated and austenitized according to the construction material of cast iron at 800 degrees C - 1000 degrees C (1073. 15K-1273.15K) (heating process). then, the metal bath immersed in 250 degrees C - 450 degrees C (523.15K-723.15K) melting tin — constant temperature — the cast iron product to which metal tin has not adhered by the heat treatment approach of cast iron of performing austempering processing which holds and (metal tin bath process) carries out air cooling (radiationnal-cooling process) is offered. As the heat treatment approach of such cast iron, there are the antisticking approach of the metal tin shown in drawing 1 R> 1, a method of seceding from the metal tin in an adhesion process, and a method of seceding from adhering metal tin.

[0009] Approach ** (the antisticking approach of metal tin)

Before austenitizing cast iron, melting tin and the surface treatment process which makes the surface treatment material which does not react cover are prepared in cast iron, and it is made for cast iron not to contact direct melting tin in metal tin bath. As for the heating time for austenitizing, it is desirable to consider as 30 minutes - 180 minutes, and it is more desirable to consider as 30 minutes - 100 minutes. In the case of less than 30 minutes, austenitizing of cast iron is not fully performed. If 180 minutes is exceeded, the oxide skin formed on the surface of cast iron will become thick. As for the time amount immersed in melting tin, it is desirable to consider as 20 minutes - 300 minutes according to the presentation condition of the cast iron considered as a request, and it is more desirable to consider as 20 minutes - 100 minutes. kaolin powder is used for surface treatment material — desirable — surface treatment material — it is desirable to use kaolin powder to 100 % of the weight 1 % of the weight to 100% of the weight. When the content of kaolin powder is less than 1 % of the weight, the spreading nature on the front face of cast iron falls. Furthermore, alumina powder can also be added to surface treatment material. in this case, surface treatment material — it is desirable to use alumina powder for kaolin powder to 100 % of the weight 1 % of the weight to 50% of the weight 1 % of the weight to 100% of the weight, and it is more desirable to use alumina powder for kaolin powder 20 % of the weight to 50% of the weight 80 % of the weight to 50% of the weight. If alumina powder exceeds [kaolin powder] 50 % of the weight less than 1% of the weight, the spreading nature on the front

face of cast iron will fall.
[0010] Approach ** (how to secede from the metal tin in an adhesion process)

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the flow chart which shows the heat treatment approach of the cast iron concerning the gestalt of operation of this invention.
[Drawing 2] It is the table Fig. showing the function of the oxide skin formed in a cast iron front face in the heating process of the heat treatment approach of cast iron, and time amount.
[Drawing 3] It is the table Fig. showing the thickness of the decarburized layer formed in a heating process, and relation with the used surface treatment material.
[Drawing 4] It is the table Fig. showing the relation between the time amount spent on the metal tin bath process and the atmospheric-air bath process, and the reinforcement of the obtained cast iron.

[Translation done.]

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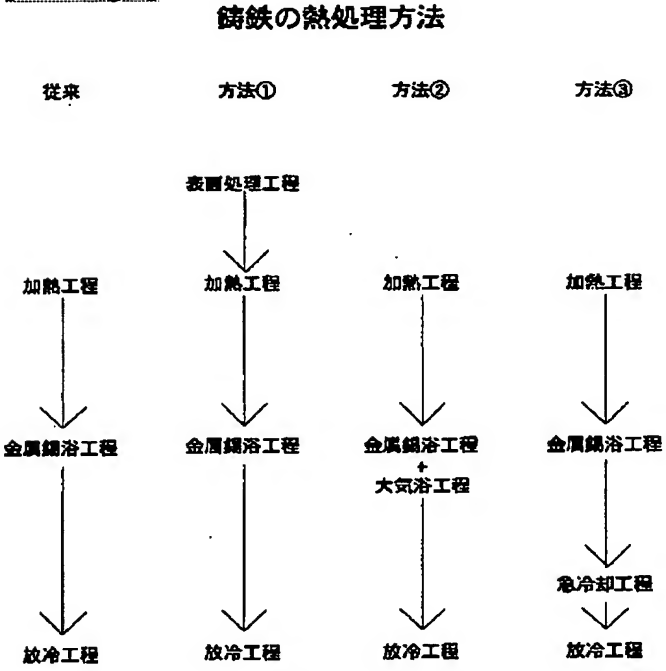
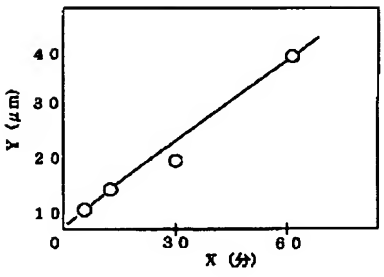
DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 3]

被覆材名	外面 (μm)	内面 (μm)
無被覆	２４	７
カオリン１００％	２０	６
カオリン５０％＋アルミナ５０％	１７	７
ベントナイト１００％	１６	５
ベントナイト５０％＋コーンスターチ５０％	２１	６

[Drawing 4]

No.	金属錫浴中の時間 (分)	大気炉での時間 (分)	引張強さ (MPa)	硬さ (HRC)
１	３０	０	１３９４	４４．７
２	２０	１０	１３９０	４３．６
３	１５	１５	１３９１	４３．４
４	１０	２０	１２７７	４１．０

[Translation done.]